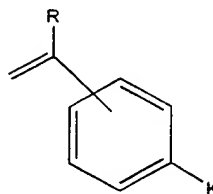
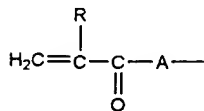
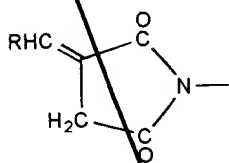


Sub B1  
cont'd

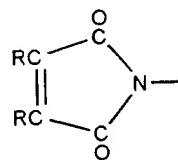
Y is an ethylenically unsaturated polymerisable group selected from the group consisting of



$\text{CH}_2=\text{C}(\text{R})-\text{CH}_2-\text{O}-$ ,  $\text{CH}_2=\text{C}(\text{R})-\text{CH}_2 \text{ OC}(\text{O})-$ ,  $\text{CH}_2=\text{C}(\text{R})\text{OC}(\text{O})-$ ,  $\text{CH}_2=\text{C}(\text{R})-\text{O}-$ ,  
 $\text{CH}_2=\text{C}(\text{R})\text{CH}_2\text{OC}(\text{O})\text{N}(\text{R}^1)-$ ,  $\text{R}^2\text{OCCCR}=\text{CRC}(\text{O})-\text{O}-$ ,  $\text{RCH}=\text{CHC}(\text{O})\text{O}-$ ,  
 $\text{RCH}=\text{C}(\text{COOR}^2)\text{CH}_2-\text{C}(\text{O})-\text{O}-$ ,



and



wherein:

R is hydrogen or a  $\text{C}_1\text{-C}_4$  alkyl group;

$\text{R}^1$  is hydrogen or a  $\text{C}_1\text{-C}_4$  alkyl group or  $\text{R}^1$  is  $-\text{B-X}$  where B and X are as defined above; and

$\text{R}^2$  is hydrogen or a  $\text{C}_{1-4}$  alkyl group or BX where B and X are as defined above;

A is  $-\text{O}-$  or  $-\text{NR}^1-$ ;

K is selected from the group consisting of  $-(\text{CH}_2)_p\text{OC}(\text{O})-$ ,  $-(\text{CH}_2)_p\text{C}(\text{O})\text{O}-$ ,  
 $-(\text{CH}_2)_p\text{OC}(\text{O})\text{O}-$ ,  $-(\text{CH}_2)_p\text{NR}^3-$ ,  $-(\text{CH}_2)_p\text{NR}^3\text{C}(\text{O})-$ ,  
 $-(\text{CH}_2)_p\text{C}(\text{O})\text{NR}^3-$ ,  $-(\text{CH}_2)_p\text{NR}^3\text{C}(\text{O})\text{O}-$ ,  $-(\text{CH}_2)_p\text{OC}(\text{O})\text{NR}^3-$ ,  
 $-(\text{CH}_2)_p\text{NR}^3\text{C}(\text{O})\text{NR}^3-$  (in which the groups  $\text{R}^3$  are the same or different),  $-(\text{CH}_2)_p\text{O}-$ ,  
 $-(\text{CH}_2)_p\text{SO}_3-$ , and optionally in combination with B, a valence bond and p is from 1 to 12 and  $\text{R}^3$  is hydrogen or a  $\text{C}_1\text{-C}_4$  alkyl group;

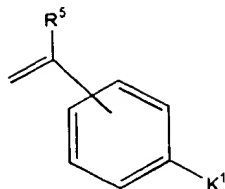
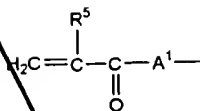
b) an aromatic group containing monomer of the general formula II



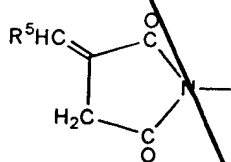
II

wherein  $\text{Y}^1$  is selected from the group consisting of

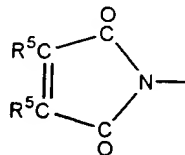
Sub 31  
cont 1



$\text{CH}_2=\text{C}(\text{R}^5)-\text{CH}_2-\text{O}-$ ,  $\text{CH}_2=\text{C}(\text{R}^5)-\text{CH}_2 \text{OC}(\text{O})-$ ,  $\text{CH}_2=\text{C}(\text{R}^5)\text{OC}(\text{O})-$ ,  $\text{CH}_2=\text{C}(\text{R}^5)-\text{O}-$ ,  
 $\text{CH}_2=\text{C}(\text{R}^5)\text{CH}_2\text{OC}(\text{O})\text{N}(\text{R}^6)-$ ,  $\text{R}^7\text{OCC}(\text{R}^5)=\text{C}(\text{R}^5)\text{C}(\text{O})-\text{O}-$ ,  $\text{R}^5\text{CH}=\text{CHC}(\text{O})\text{O}-$ ,  
 $\text{R}^5\text{CH}=\text{C}(\text{COOR}^7)\text{CH}_2-\text{C}(\text{O})-\text{O}-$ ,



and



wherein:

$\text{R}^5$  is hydrogen or a  $\text{C}_1-\text{C}_4$  alkyl group;

$\text{R}^6$  is hydrogen or a  $\text{C}_1-\text{C}_4$  alkyl group or  $\text{R}^6$  is  $\text{R}^4$ ;

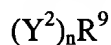
$\text{R}^7$  is hydrogen or a  $\text{C}_{1-4}$  alkyl group or  $\text{R}^4$ ;

$\text{A}^1$  is  $-\text{O}-$  or  $-\text{NR}^6-$ ;

$\text{K}^1$  is selected from the group consisting of  $-(\text{CH}_2)_q\text{OC}(\text{O})-$ ,  $-(\text{CH}_2)_q\text{C}(\text{O})\text{O}-$ ,  
 $-(\text{CH}_2)_q\text{OC}(\text{O})\text{O}-$ ,  $-(\text{CH}_2)_q\text{NR}^8-$ ,  $-(\text{CH}_2)_q\text{NR}^8\text{C}(\text{O})-$ ,  
 $-(\text{CH}_2)_q\text{C}(\text{O})\text{NR}^8-$ ,  $-(\text{CH}_2)_q\text{NR}^8\text{C}(\text{O})\text{O}-$ ,  $-(\text{CH}_2)_q\text{OC}(\text{O})\text{NR}^8-$ ,  
 $-(\text{CH}_2)_q\text{NR}^8\text{C}(\text{O})\text{NR}^8-$  (in which the groups  $\text{R}^8$  are the same or different),  $-(\text{CH}_2)_q\text{O}-$ ,  
 $-(\text{CH}_2)_q\text{SO}_3-$ , and a valence bond and  $p$  is from 1 to 12 and  $\text{R}^8$  is hydrogen or a  $\text{C}_1-\text{C}_4$   
 alkyl group;

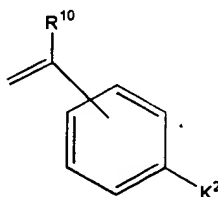
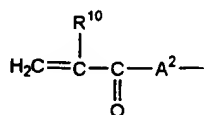
and  $\text{R}^4$  is an aromatic group; and

c) a cross-linking monomer of the general formula III



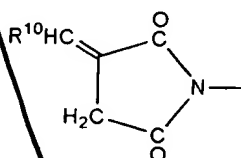
III

in which  $n$  is an integer of at least 2, each  $\text{Y}^2$  is selected from the group consisting of

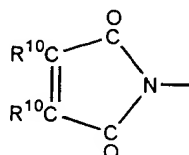


Sub B1  
cont'd

$\text{CH}_2=\text{C}(\text{R}^{10})-\text{CH}_2-\text{O}-$ ,  $\text{CH}_2=\text{C}(\text{R}^{10})-\text{CH}_2 \text{OC}(\text{O})-$ ,  $\text{CH}_2=\text{C}(\text{R}^{10})\text{OC}(\text{O})-$ ,  $\text{CH}_2=\text{C}(\text{R}^{10})-\text{O}-$ ,  
 $\text{CH}_2=\text{C}(\text{R}^{10})\text{CH}_2\text{OC}(\text{O})\text{N}(\text{R}^{11})-$ ,  $\text{R}^{12}\text{OOC}\text{CR}^{10}=\text{CR}^{10}\text{C}(\text{O})-\text{O}-$ ,  
 $\text{R}^{10}\text{CH}=\text{CH}\text{C}(\text{O})\text{O}-$ ,  $\text{R}^{10}\text{CH}=\text{C}(\text{COOR}^{12})\text{CH}_2-\text{C}(\text{O})-\text{O}-$ ,



and



wherein:

$\text{R}^{10}$  is hydrogen or a  $\text{C}_1$ - $\text{C}_4$  alkyl group;

$\text{R}^{11}$  is hydrogen or a  $\text{C}_1$ - $\text{C}_4$  alkyl group;

$\text{R}^{12}$  is hydrogen or a  $\text{C}_1$ - $\text{C}_4$  alkyl group;

$\text{A}^2$  is  $-\text{O}-$  or  $-\text{NR}^{11}-$ ;

$\text{K}^2$  is selected from the group consisting of  $-(\text{CH}_2)_r\text{OC}(\text{O})-$ ,  $-(\text{CH}_2)_r\text{C}(\text{O})\text{O}-$ ,  
 $-(\text{CH}_2)_r\text{OC}(\text{O})\text{O}-$ ,  $-(\text{CH}_2)_r\text{NR}^{12}-$ ,  $-(\text{CH}_2)_r\text{NR}^{12}\text{C}(\text{O})-$ ,  
 $-(\text{CH}_2)_r\text{C}(\text{O})\text{NR}^{12}-$ ,  $-(\text{CH}_2)_r\text{NR}^{12}\text{C}(\text{O})\text{O}-$ ,  $-(\text{CH}_2)_r\text{OC}(\text{O})\text{NR}^{12}-$ ,  
 $-(\text{CH}_2)_r\text{NR}^{12}\text{C}(\text{O})\text{NR}^{12}-$  (in which the groups  $\text{R}^{12}$  are the same or different),  
 $-(\text{CH}_2)_r\text{O}-$ ,  $-(\text{CH}_2)_r\text{SO}_3-$  - and a valence bond and  $r$  is from 1 to 12 and  $\text{R}^{12}$  is hydrogen  
or a  $\text{C}_1$ - $\text{C}_4$  alkyl group;

and  $\text{R}^9$  is an n-functional organic group.

33. A polymer according to claim 32 in which  $\text{R}^4$  is benzyl or phenyl.

34. A polymer according to claim 32 in which  $\text{Y}$  and  $\text{Y}^2$  are the same, and are  $\text{CH}_2=\text{CR}^x\text{COA}$ , in which  $\text{R}^x$  is methyl or hydrogen and  $\text{A}$  is  $\text{O}$ .

35. A polymer according to claim 32 in which the cross-linking monomer comprises a compound of the general formula III in which  $\text{R}^9$  is an aromatic group.

36. A polymer according to claim 32 in which the crosslinking monomer comprises a compound of the formula III in which  $\text{R}^9$  is an aliphatic group.

37. A polymer according to claim 32 in which the monomers include a mixture of at least two cross-linking monomers of the general formula III, in at least one of which  $\text{R}^9$  is an aromatic group and in at least one of which  $\text{R}^9$  is an aliphatic group.

100260-51325360

A

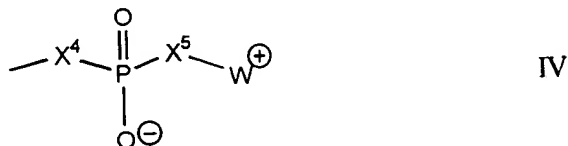
Sub B2  
38. A polymer according to claim 37 in which the molar ratio of crosslinking monomer in which R<sup>9</sup> is aromatic to crosslinking monomer in which R<sup>9</sup> is aliphatic is in the range 10:1 to 1:10, preferably 5:1 to 1:5, most preferably 2:1 to 1:2.

39. A polymer according to claim 32 in which the zwitterionic monomer is present in molar amount in the range 1 to 95% based on total ethylenically unsaturated monomer.

40. A polymer according to claim 32 in which the aromatic group containing monomer is present in a molar amount in the range 10 to 99% based on total ethylenically unsaturated monomer.

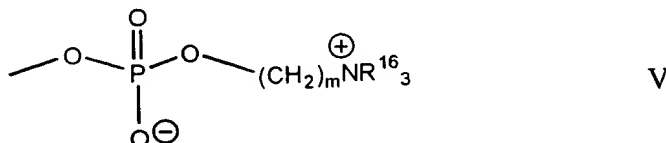
41. A polymer according to claim 32 in which the crosslinking monomer is present in a molar amount in the range 0.01 to 10% based on total ethylenically unsaturated monomer.

42. A polymer according to claim 32 in which the zwitterionic group has the general formula IV



in which the moieties X<sup>4</sup> and X<sup>5</sup>, which are the same or different, are -O-, -S-, -NH- or a valence bond and W<sup>+</sup> is a group comprising an ammonium, phosphonium or sulphonium cationic group and a group linking the anionic and cationic moieties which is a C<sub>1-12</sub>-alkylene group.

43. A polymer according to claim 42 in which X is a group of formula V:



where the groups R<sup>16</sup> are the same or different and each is hydrogen or C<sub>1-4</sub> alkyl, and

m is from 1 to 4.

44. A gel comprising a polymer according to claim 32 swollen by a liquid.

45. A gel according to claim 44 in which the liquid is aqueous.

46. A refractive device formed of a polymer according to claim 32.

47. A device according to claim 46 which has an average transmission for visible light in the range 400 to 700nm wavelength of at least 90% when swollen by water.

48. A device according to claim 46 which comprises an absorber of electromagnetic radiation.

49. A device according to claim 46, having a refractive index when fully swollen in water in the range 1.45-1.60.

50. A polymerisation process in which a polymerisation mixture containing ethylenically unsaturated monomers is subjected to radical polymerisation, whereby addition polymerisation of the ethylenically unsaturated groups takes place, and in which the monomers include

a) a zwitterionic monomer of the general formula I

YBX

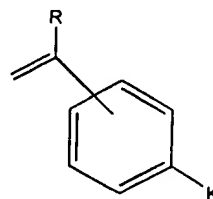
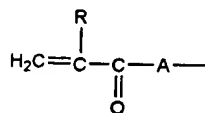
I

wherein

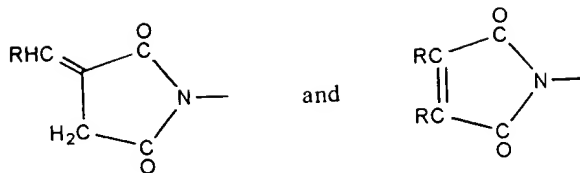
B is a straight or branched alkylene, oxaalkylene or oligo-oxaalkylene chain optionally containing one or more fluorine atoms or, if X or Y contains a terminal carbon atom bonded to B, a valence bond;

X is a zwitterionic group; and

Y is an ethylenically unsaturated polymerisable group selected from the group consisting of



$\text{CH}_2=\text{C}(\text{R})-\text{CH}_2-\text{O}-$ ,  $\text{CH}_2=\text{C}(\text{R})-\text{CH}_2 \text{ OC}(\text{O})-$ ,  $\text{CH}_2=\text{C}(\text{R})\text{OC}(\text{O})-$ ,  $\text{CH}_2=\text{C}(\text{R})-\text{O}-$ ,  
 $\text{CH}_2=\text{C}(\text{R})\text{CH}_2\text{OC}(\text{O})\text{N}(\text{R}^1)-$ ,  $\text{R}^2\text{OOCRC}=\text{CRC}(\text{O})-\text{O}-$ ,  $\text{RCH}=\text{CHC}(\text{O})\text{O}-$ ,  
 $\text{RCH}=\text{C}(\text{COOR}^2)\text{CH}_2-\text{C}(\text{O})-\text{O}-$ ,



wherein:

R is hydrogen or a C<sub>1</sub>-C<sub>4</sub> alkyl group;

R<sup>1</sup> is hydrogen or a C<sub>1</sub>-C<sub>4</sub> alkyl group or R<sup>1</sup> is -B-X where B and X are as defined above; and

R<sup>2</sup> is hydrogen or a C<sub>1-4</sub> alkyl group or BX where B and X are as defined above;

A is -O- or -NR<sup>1</sup>-;

K is selected from the group consisting of -(CH<sub>2</sub>)<sub>p</sub>OC(O)-, -(CH<sub>2</sub>)<sub>p</sub>C(O)O-, -(CH<sub>2</sub>)<sub>p</sub>OC(O)O-, -(CH<sub>2</sub>)<sub>p</sub>NR<sup>3</sup>-, -(CH<sub>2</sub>)<sub>p</sub>NR<sup>3</sup>C(O)-, -(CH<sub>2</sub>)<sub>p</sub>C(O)NR<sup>3</sup>-, -(CH<sub>2</sub>)<sub>p</sub>NR<sup>3</sup>C(O)O-, -(CH<sub>2</sub>)<sub>p</sub>OC(O)NR<sup>3</sup>-, -(CH<sub>2</sub>)<sub>p</sub>NR<sup>3</sup>C(O)NR<sup>3</sup>- (in which the groups R<sup>3</sup> are the same or different), -(CH<sub>2</sub>)<sub>p</sub>O-, -(CH<sub>2</sub>)<sub>p</sub>SO<sub>3</sub>-, and optionally in combination with B, a valence bond and p is from 1 to 12 and R<sup>3</sup> is hydrogen or a C<sub>1</sub>-C<sub>4</sub> alkyl group.

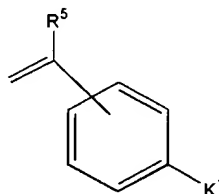
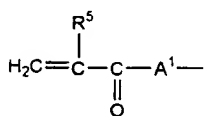
b) an aromatic group containing monomer of the general formula II



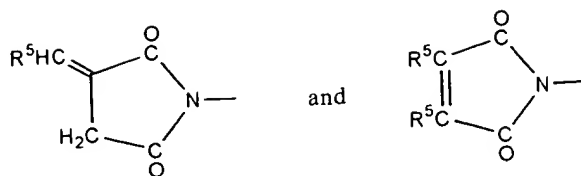
II

wherein Y<sup>1</sup> is  
group

selected from the  
consisting of



CH<sub>2</sub>=C(R<sup>5</sup>)-CH<sub>2</sub>-O-, CH<sub>2</sub>=C(R<sup>5</sup>)-CH<sub>2</sub> OC(O)-, CH<sub>2</sub>=C(R<sup>5</sup>)OC(O)-, CH<sub>2</sub>=C(R<sup>4</sup>)-O-,  
CH<sub>2</sub>=C(R<sup>5</sup>)CH<sub>2</sub>OC(O)N(R<sup>6</sup>)-, R<sup>7</sup>OOCCR<sup>5</sup>=CR<sup>5</sup>C(O)-O-, R<sup>5</sup>CH=CHC(O)O-,  
R<sup>5</sup>CH=C(COOR<sup>7</sup>)CH<sub>2</sub>-C(O)-O-,



wherein:

$R^5$  is hydrogen or a  $C_1$ - $C_4$  alkyl group;

$R^6$  is hydrogen or a  $C_1$ - $C_4$  alkyl group or  $R^6$  is  $R^4$ ;

$R^7$  is hydrogen or a  $C_1$ - $C_4$  alkyl group or  $R^4$ ;

$A^1$  is  $-O-$  or  $-NR^6-$ ;

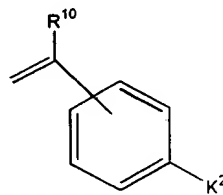
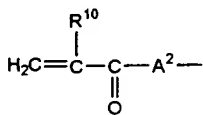
$K^1$  is selected from the group consisting of  $-(CH_2)_qOC(O)-$ ,  $-(CH_2)_qC(O)O-$ ,  $-(CH_2)_qOC(O)O-$ ,  $-(CH_2)_qNR^8-$ ,  $-(CH_2)_qNR^8C(O)-$ ,  $-(CH_2)_qC(O)NR^8-$ ,  $-(CH_2)_qNR^8C(O)O-$ ,  $-(CH_2)_qOC(O)NR^8-$ ,  $-(CH_2)_qNR^8C(O)NR^8-$  (in which the groups  $R^8$  are the same or different),  $-(CH_2)_qO-$ ,  $-(CH_2)_qSO_3-$ , and a valence bond and  $p$  is from 1 to 12 and  $R^8$  is hydrogen or a  $C_1$ - $C_4$  alkyl group;

and  $R^4$  is an aromatic group; and

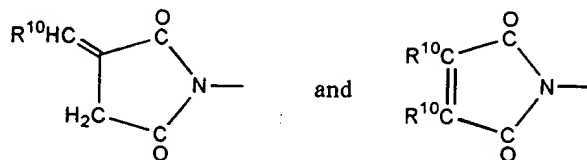
c) a cross-linking monomer of the general formula III



in which  $n$  is an integer of at least 2, each  $Y^2$  is selected from the group consisting of



$CH_2=C(R^{10})-CH_2-O-$ ,  $CH_2=C(R^{10})-CH_2OC(O)-$ ,  $CH_2=C(R^{10})OC(O)-$ ,  $CH_2=C(R^{10})O-$ ,  $CH_2=C(R^{10})CH_2OC(O)N(R^{11})-$ ,  $R^{12}OOCCH(R^{10})=CHC(O)-O-$ ,  $R^{10}CH=CHC(O)O-$ ,  $R^{10}CH=C(COOR^{12})CH_2-C(O)-O-$ ,



wherein:

$R^{10}$  is hydrogen or a  $C_1$ - $C_4$  alkyl group;





either the groups  $R^{14}$  are the same or different and each is hydrogen, selected from the group consisting of alkyl of 1 to 4 carbon atoms and aryl, or two of the groups  $R^{14}$  together with the nitrogen atom to which they are attached form a heterocyclic ring containing from 5 to 7 atoms or the three groups  $R^{14}$  together with the nitrogen atom to which they are attached form a fused ring structure containing from 5 to 7 atoms in each ring, and optionally one or more of the groups  $R^{14}$  is substituted by a hydrophilic functional group, and

the groups  $R^{15}$  are the same or different and each is  $R^{14}$  or a group  $OR^{14}$ , where  $R^{14}$  is as defined above; or

Het is an aromatic nitrogen-, phosphorus- or sulphur- containing ring.

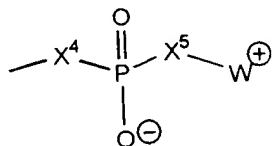
67. A polymer according to claim 43 in which  $m$  is 2 and each  $R^{16}$  is methyl.

68. A process according to claim 60 in which the solvent is removed from the polymer after the polymer has been removed from the mould, and in which the polymer is subsequently swollen in an aqueous liquid.

69. A process according to claim 50 in which the monomers include a mixture of at least two cross-linking monomers of the general formula III, in at least one of which  $R^9$  is an aromatic group and in at least one of which  $R^9$  is an aliphatic group.

70. A process according to claim 69 in which the zwitterionic monomer is present in a molar amount in the range 10 to 25%. The aromatic group containing monomer is present in a molar amount in the range 75 to 90% and the cross-linking monomer is present in a molar amount in the range 0.5 to 3%, each based on total ethylenically unsaturated monomer.

71. A process according to claim 50 in which the zwitterionic group has the general formula IV



IV

in which the moieties  $X^4$  and  $X^5$ , which are the same or different, are -O-, -S-, -NH- or a valence bond and  $W^+$  is a group comprising an ammonium, phosphonium or sulphonium cationic group and a group linking the anionic and cationic moieties which is a  $C_{1-12}$ -alkylene group.

72. A process according to claim 71 in which  $X$  is a group of formula V: